

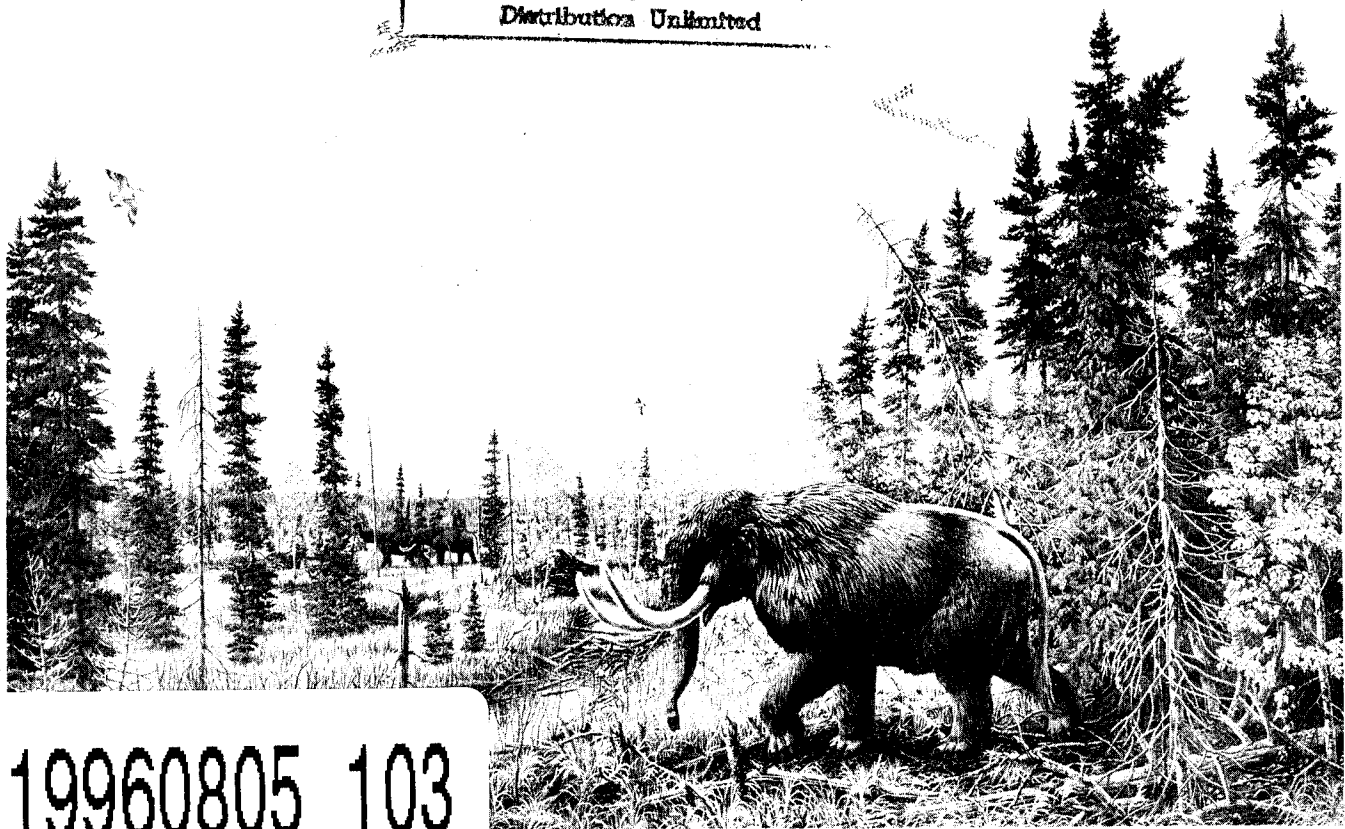
# PALEONTOLOGICAL RESOURCES SURVEY

TEBO, SOUTH GRAND AND OSAGE ARMS  
HARRY S. TRUMAN DAM AND RESERVOIR  
OSAGE RIVER BASIN, MISSOURI

By  
Jeffrey J. Saunders, Ph. D.

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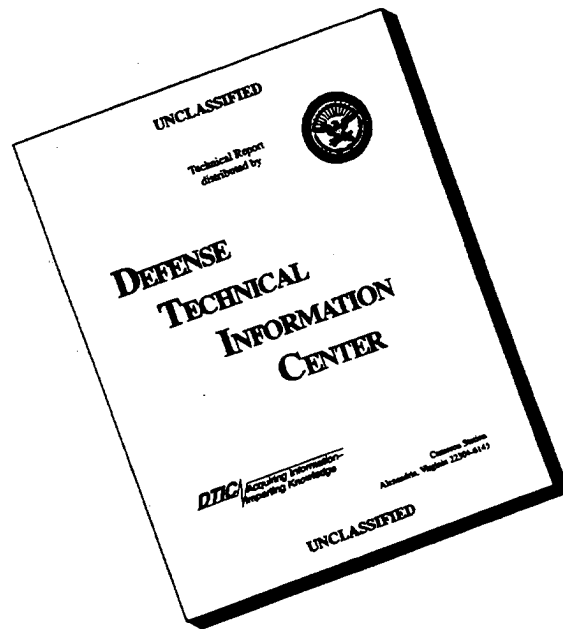
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19. (cont'd.) St. Clair County. There are no known paleontological localities occurring within the impoundment area in Cedar, Henry, and Vernon counties.

Site specific survey conducted under this contract in the Tebo, South Grand and Osage arms of the HST project area revealed 19 spring or spring-like sites. Eight (=42%) were tested. One was found to contain isolated remains of *Mammuth americanum* and the symphysis of a human mandible which probably represents a fragment of a Recent interment. Another was found to contain artifacts and a well developed, though probably Holocene, organic stratum. A third contained the major remains of another probably Recent human interment.

It is the expressed conclusion of the present writer that one spring site located during this survey represents the historically important locality of Whipple's 1843 discoveries and which has been called Tackner, Wickliff farm and Warsaw Swamp by various authors.

PALEONTOLOGICAL RESOURCES SURVEY

TEBO, SOUTH GRAND AND OSAGE ARMS  
HARRY S. TRUMAN DAM AND RESERVOIR  
OSAGE RIVER BASIN, MISSOURI

Final Report

Prepared for

The Department of the Army  
Corps of Engineers  
Kansas City District

Contract #DACW41-77-M-0228

by

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Quaternary Studies Center  
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Springfield, Illinois 62706

November 1977

Cover illustration: Mastodons shown browsing in a reconstructed environment 16,000 years ago at Boney Spring, Benton County.  
Reconstruction by Robert G. Larson, Illinois State Museum.  
Photograph by Marlin Roos, Illinois State Museum.

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I thank Mr. Ken Lasswell, Mr. Herb Brown, Mr. Dan White, and Mr. Ike Parker of Clinton who guided me on a tour of the western impoundment area, and who introduced me to Mr. James Attebery, of Lowry City, who provided information regarding Magnolia Springs and Springstude Marsh.

Finally, I thank those whose names I do not know for stories which should not be forgotten. I am particularly grateful to those who retold the tales of merry-go-rounds, moonshine and misbehavior at White Sulphur Springs.

## ABSTRACT

Construction of the Harry S. Truman Dam and Reservoir project has refocused national scientific attention on the Osage River and its tributaries in west-central Missouri. Since 1840 this area has served as the arena for debate of the contemporaneity and actual association of man with mastodon and data from its spring sites continue to bear on this controversy.

The HST project area contains significant paleontological resources. Tabulation shows that there are 11 paleontological localities within the HST project area in four of the seven counties affected by impoundment. Three of these are in Bates County; these are all localities of isolated fossil remains. Three are in Benton County, including one discovered during the course of this survey. Of these, two are fossil assemblage localities, one of which is historically important; one newly discovered is a locality of isolated fossil materials. Four are in Hickory County. Of these, all are fossil assemblage localities, and two are historically important. There is a single locality of isolated fossil material in St. Clair County. There are no known paleontological localities occurring within the impoundment area in Cedar, Henry and Vernon counties.

Site specific survey conducted under this contract in the Tebo, South Grand and Osage arms of the HST project area revealed 19 spring or spring-like sites. Eight (=42%) were tested. One was found to contain isolated remains of *Mammot americanum* and

the symphysis of a human mandible which probably represents a fragment of a Recent interment. Another was found to contain artifacts and a well developed, though probably Holocene, organic stratum. A third contained the major remains of another probably Recent human interment.

It is the expressed conclusion of the present writer that one spring site located during this survey represents the historically important locality of Whipple's 1843 discoveries and which has been called Tackner, Wickliff farm and Warsaw Swamp by various authors.

## GLOSSARY OF TECHNICAL TERMS

*alluvium (alluvial)* - that sediment which occurs in stream valleys (pertaining to alluvium).

*archaeology (archaeological)* - the scientific study of man's cultural history utilizing non-written records (pertaining to archaeology).

*artesian* - the term applied to ground water under sufficient pressure to rise above the aquifer containing it; when artesian water intersects the land surface, it is said to be an artesian spring.

*biota (biotic)* - the animal and plant life of a region; flora and fauna collectively (pertaining to biota).

*caudal vertebrae* - in vertebrate animals, the vertebrae comprising the tail.

*clast (clastic)* - the individual particles comprising a sediment or sedimentary rock produced by the natural disintegration of a parental mass (pertaining to clast).

*colluvium (colluvial)* - sediments occurring at the base of a slope or cliff and brought there chiefly by gravity (pertaining to colluvium).

*crania* - plural of cranium; in vertebrate animals, the brain case (see vertebrates),

*crown* - the enamel-capped portion of a tooth, distinct from root.

*dolomite* - is used herein to denote a sedimentary rock with a high ratio of magnesium to calcium carbonate.

*fossil* - the actual remains or simple traces of animals or plants which have been preserved by natural causes in the earth's crust exclusive of organisms which have been buried since the beginning of the Holocene; fossils can therefore be remains or traces of extant as well as extinct organisms.

*Holocene (=Recent)* - time and strata younger than the Pleistocene;  
Holocene + Pleistocene = Quaternary.

*limestone* - is used herein to denote a sedimentary rock with a low ratio of magnesium to calcium carbonate.

*lumbar vertebrae* - in vertebrate animals, the vertebrae comprising the lower back, occurring between the ribs and the bones of the hips.

*mammoth* - a member of an extinct group of proboscideans, characterized by large size, great bulk, and grazing habits.

*mastodon* - a member of an extinct group of proboscideans, characterized by medium size, great bulk and browsing habits.

*Mammuth americanum* and *Mastodon americanus* are two names for a species of mastodon very common in the Pleistocene of North America and called, commonly, the American mastodon (the latter scientific name is no longer valid).

*occlusal surface(s)* - those portions of tooth crowns which contact one another during chewing motions.

*overbank deposit* - sediment deposited by a river during times of overbank flooding.

*paleontology (paleontological)* - the scientific study of fossil remains of both plants and animals (pertaining to this study).

*palynology (palynological)* - the branch of paleontology that studies plant pollen and spores (pertaining to this study).

*peat* - a dark brown or black organic substance produced by the partial decomposition and disintegration of plants that grow in marshes and similar wet areas.

*phalanges* - plural of phalanx; in vertebrate animals, the bones comprising the toes.

*Pleistocene* - the so-called Glacial epoch or Ice Age; representing the last 3 million years of geological time, exclusive of the most recent 10,000 years called the Holocene.

*proboscideans* - individuals comprising the Proboscidea, an order of mammals characterized by tendencies for large size, the development of a proboscis (trunk), and with teeth modified for an herbivorous diet, including the living elephants and their extinct relatives.

*spring* - a place where, without the influence of man, water flows from a rock or soil upon the land or into a body of surface water.

*symphysis* - in vertebrate animals, the point at which the right and left jaw halves unite and fuse to form the mandible, i.e., the chin.

*thoracic vertebrae* - in vertebrate animals, the rib-bearing vertebrae of the chest region.

*vertebrates* - animals with backbones, more specifically an individual of the subphylum Vertebrata, a group of animals characterized by the possession of a vertebral column, and a skeletal encasement for the brain (brain case or cranium).



Paleontological Resources Survey  
Tebo, South Grand and Osage Arms  
Harry S. Truman Dam and Reservoir  
Osage River Basin, Missouri

Introduction and Statement of Cultural Significance

Construction of the Harry S. Truman Dam and Reservoir project has caused national scientific attention to be refocused on the Osage River and its tributaries in west-central Missouri. It was from a spring in this area that Albert C. Koch, of St. Louis, recovered, in 1840, portions of several mastodon skeletons which he assembled as "*Missourium*", a composite creature 4.5m (15 ft) high and 9m (30ft) long, for which Koch claimed a contemporaneity with man (Koch 1857). Koch's claim stirred a controversy that has continued down to the present day (Wormington 1957:101-102; McMillan 1976). Moreover, Koch's reconstructions and postulations were occurring during a time of development of vertebrate paleontology in North America when the identity and acceptance of many extinct forms (including the mastodon) were still resisted by many prominent naturalists and philosophers. History has in fact shown (Green 1959:96-133) that no animal played a greater role in this development than the American mastodon (*Mammut americanum*), and no area displayed greater quantities of this creature than the valleys of the great interior rivers of North America, including, prominently, the Osage and its tributaries in Missouri.

Since 1959 state and federal government-funded agencies and contractors have been involved in an analysis of the geological,

palynological, paleontological, archaeological and historical-cultural records of the area to be affected by water impoundment in Bates, Benton, Cedar, Henry, Hickory, St. Clair and Vernon counties, Missouri.

The project area contains significant paleontological resources (Koch 1857, Lay 1876, Hay 1924, Mehl 1962, Mehringer, King and Lindsay 1970, King 1973, King and Lindsay 1976, Saunders 1977). To date there has been one Corps-sponsored survey for spring deposits containing paleontological resources (King 1975). This survey yielded negative results for the discovery of additional fossil-containing spring deposits in the Pomme de Terre arm. However, there have been reported finds elsewhere in the reservoir area (LeConte 1854, Lay 1876, Hay 1924).

The endeavor reported here has had two distinct purposes, which were 1) to undertake an analysis of the known paleontological sites within the project area and the existing collections from those sites, and 2) to undertake a site specific survey for spring deposits containing paleontological resources in the project area, particularly areas not previously surveyed. The Pomme de Terre arm of the HST project area has been surveyed by King (1975). In addition, this area is the locus of work currently in progress (see below). The Tebo, South Grand and Osage arms of the HST project area, however, had not been surveyed for paleontological resources and they represent the loci of the current site specific survey, the results of which are presented below. Figure

1 shows the survey area, which is exclusive of the Pomme de Terre arm south of Fairfield; it is bounded approximately by Warsaw on the east, Clinton on the north and by Monegaw Springs on the west and south.

Given the archaeological significance of 19th century collections from Koch Spring in Hickory County, presented in the opening paragraph, it is relevant to ask if spring sites might exist in other arms of the HST project area in which artifacts or human remains and extinct animal remains might co-occur? If in fact there is co-occurrence, it is then necessary to examine the association more closely, from point of view of geological context, in an effort to determine if the co-occurrence is fortuitous (as all have been to date, but need not be, given the well established antiquity of man in the HST project area). On the other hand, if artifacts or human remains are found in spring sites, but extinct animals are not, it is nevertheless necessary to explain the occurrence. This is the task of the archaeologist, of course, rather than the paleontologist, but it does illustrate how and why the data derived during the course of this survey may be important in furthering an understanding of the human prehistory of the area and it does, in addition, demonstrate the potential interfacing of the archaeologist and paleontologist, working together. That such interfacing is in fact mandatory in this instance is shown by the results of this survey, reported below.

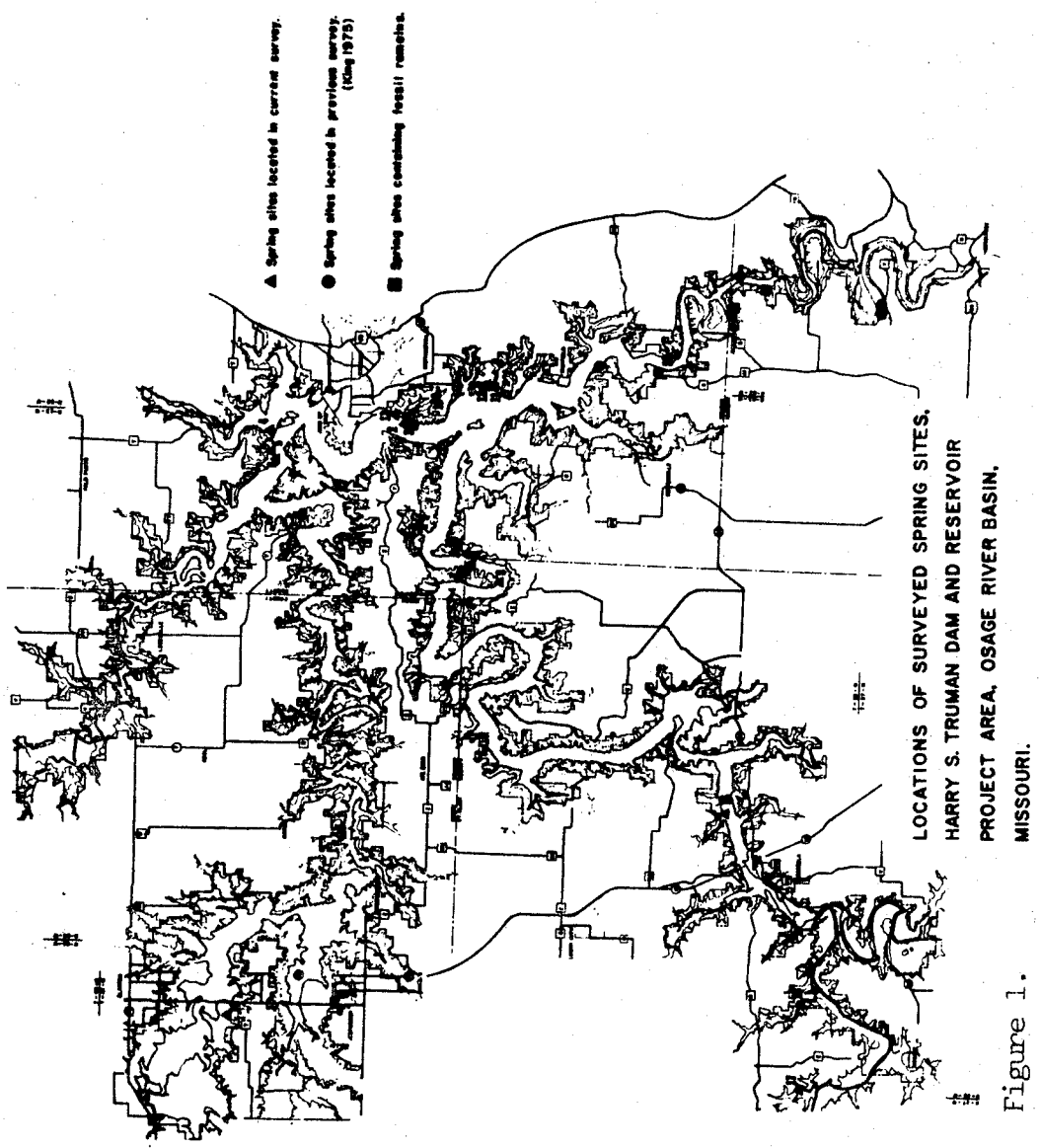


Figure 1.

### Assessment of Known Paleontological Sites and Materials

During the course of this project, an analysis of known paleontological sites which occur in the HST project area was conducted to quantify and assess currently available, though scattered, information. M. G. Mehl (1962), compiling from a number of sources (including Broadhead 1869, 1874, and 1881, and Hay 1924), provided an initial framework for Pleistocene vertebrate fossil occurrences and remains in Missouri. Localities occurring in the project area, known prior to 1962, can be collated from Mehl's report. This information is present in Table 1. Table 1 also includes, for completeness, four spring sites in the Pomme de Terre River valley which were rediscovered, or discovered and excavated, subsequent to Mehl's summary. It is a complete listing of hitherto known vertebrate fossil localities occurring in the HST project area.

Isolated fossil materials. Four localities listed in Table 1 (MGSQV 1018, 1022, 1040 and 1074) have produced only isolated fossil vertebrate elements.

MGSQV 1018 was first reported by Broadhead in 1869 (p. 20) who mentioned the discovery of a fossil horse tooth at Papinsville, at a depth of 31 feet. In 1874 he (Broadhead 1874:157) again referred to this specimen, stating that "wells dug at Papinsville show 31 feet of yellow clay resting on 4 inches of blue clay and gravel. Beneath this was found a thin sandy stratum which inclosed the tooth of the extinct horse. Underneath this, again, was a gravel bed 5 feet thick." Hay (1924:139) examined the spec-

TABLE 1. Vertebrate fossil localities occurring within the Harry S. Truman Dam and Reservoir project area.

County	Site Number	Location	Name
Bates	MGSQV 1018	"well at Papinsville"	Papinsville Horse
Bates	MGSQV 1022	"Marais des Cygnes bluff"	Papinsville Tusk
Bates	MGSQV 1074	"Marais des Cygnes bank"	Marais des Cygnes Jaw
Benton	MGSQV 1006*	NE $\frac{1}{4}$ sec. 25, T.40N., R.23W.	Whipple's Locality
Benton	A7117**	SW $\frac{1}{4}$ sec. 29, T.29N., R.22W.	Boney Spring
Cedar	-----	-----	-----
Henry	-----	-----	-----
Hickory	MGSQV 1001*,**	NE $\frac{1}{4}$ sec. 15, T.38N., R.22W.	Koch Spring
Hickory	-----*	NE $\frac{1}{4}$ sec. 9, T.38N., R.22W.	Kirby Spring
Hickory	-----**	NE $\frac{1}{4}$ sec. 9, T.38N., R.22W.	Jones Spring
Hickory	23HI210**	NE $\frac{1}{4}$ sec. 9, T.38N., R.22W.	Trolinger Spring
St. Clair	MGSQV 1040	"bed of the Osage River"	Osceola Mastodon
Vernon	-----	-----	-----

Symbols:

- \* localities which are historically important
- \*\* localities discovered subsequent to Mehl's (1962) summary
- A a University of Arizona Laboratory of Paleontology locality
- MGSQV a Missouri Geological Survey Quaternary vertebrate locality
- 23HI210 a Missouri Archaeological Survey site (Smithsonian trinomial system)

imen and noted that it was well worn, well fossilized and specifically indeterminable. He provided the following measurements from the specimen: occlusal length = 27.5mm, occlusal width = 22mm. Mehl (1962:94) stated that this specimen is in the collections at the University of Missouri, Columbia, where it is cataloged as V.P.694. Through the courtesy of Dr. R. L. Ethington, Department of Geology, University of Missouri, Columbia, I searched for this specimen in the current collections. It could not be found; the number given by Mehl (V.P.694) is presently registered as "unused".

MGSQV 1022 was initially reported by Broadhead in 1881 (p. 521) who stated that "in the gravel beds at Papinsville, a tooth of an extinct species of horse was found, together with freshwater shells [MGSQV 1018]. On the river bluff nearby a mastodon tusk 7 feet 4 inches long was found in the gravel". Hay (1924:25) is of the opinion that this tusk, whether mastodon or mammoth, had probably been washed out of the bank of the stream. Nothing more is known of either the context of recovery or of the specimen's current status.

MGSQV 1074 was reported by Mehl (1962:98) who stated that Mr. T. H. Hutchinson had four years previously found an artiodactyl, presumably *Bison* sp., jaw with several teeth on a bank of the Marais des Cygnes River in Bates County. He further stated that this specimen is in the Wildlife Laboratories collection at the University of Missouri, where I have not located it.

Finally, MGSQV 1040 was initially reported by Hay (1924:29)

who received a sketch of a second upper molar of *Mammut americanum* (the American mastodon) drawn and sent by the discoverer, Mr. Edward Butts of Kansas City, Missouri. The latter stated he had dredged the tooth up with gravel from the bed of the Osage River at Osceola. Hay reported the following measurement from the specimen: crown length = 96mm; he stated that whereas the specimen was little worn, the roots were well developed. In 1924 the specimen was in the possession of Mr. Butts.

Each of these isolated occurrences is accompanied by data which are insufficient for rediscovery. While Mehl's notes (on file in the Missouri Department of Natural Resources, Division of Geology and Land Survey, Rolla, where they were examined by the present writer) state that MGSQV 1018 is, with question, in sec. 16, T.30N., R.30W. [which is actually to read sec. 16, T.38N., R. 30W.] this is the section occupied, partially, by Papinsville and does nothing to resolve a place of discovery. Moreover, the discovery was made in a well, which in itself implies slight chance of rediscovery. Nevertheless I visited the Marais de Cynges River at Papinsville to seek establishment of the yellow clay - blue clay and gravel - sand and gravel stratigraphic sequence reported by Broadhead in 1881 (p. 521) and to search existing exposures for fossil remains. The Marais des Cynges is however currently deeply incised into laminated dark gray silty clay representing overbank deposits containing abundant organic residues. If the sequence reported by Broadhead was ever exposed along the river course, it appears that intensive agriculture, coupled with



periodic flooding (the flood of 1951 is remembered here as one of particularly extreme severity), has thoroughly altered it. Similarly, the two other localities (MGSQV 1022 and 1074) listed as occurring in Bates County present little chance of rediscovery or assessment, based on available locality information. Finally, rapid, short-term phenomena are continually affecting the Osage River at Osceola, and search for earlier reported localities is at best chance-filled; when these localities are reported as "the bed of the Osage River" (MGSQV 1040), rediscovery and assessment is of course impossible.

It is my expressed opinion that such chance discoveries of isolated specimens will continue in the HST project area. The rapid, short-term phenomena mentioned above continually alter all river courses. During these transformations isolated fossils are continuously exposed, to remain stable for a very short time, and finally and usually to disappear through either mechanical or chemical destruction or through redeposition (if the latter, to start the cycle all over again). When these events are intersected by a chance observer, as in the four instances discussed above, a discovery often ensues. There is no way to mitigate the loss to science of such specimens/resources (except, perhaps, more public awareness); on the other hand, it is often difficult to assess the scientific significance of isolated discoveries. Fossil remains, just like forms of life currently extant, are best understood and interpreted when they are associated with others; in the fossil situation these associates are together in

an assemblage, in the extant context these associates are together in a population or community. It is to a consideration of fossil assemblages occurring in the HST project area that this report now turns.

Localities with historical importance. Three localities listed in Table 1 (MGSQV 1006, MGSQV 1001, and Kirby Spring) have special historic interest. Each of these is discussed below, together with an assessment of the current status of their collections.

Earliest acceptable reference to MGSQV 1006, which Lay (1876) called the Wickliff farm and which Hay (1924) called Tackner is in 1843 in a statement by Mr. S. H. Whipple of Warsaw which accompanied bones from Benton County displayed at the Academy of Natural Sciences of Philadelphia (*Proceedings* 1843). In 1847 the American Philosophical Society, of Philadelphia, purchased these and possibly other bones from Whipple, together with the following regarding their origin:

"These bones were found in the County of Benton, Missouri, about one-half mile from the river Osage, seventy miles south of the Missouri river, at Boonville; in North latitude,  $38^{\circ} 10'$ , and in  $16^{\circ} 40'$  West longitude. The County of Benton, south of the Osage, and bordering thereon, is characterized for its irregular and broken appearance, running up into extensive ridges, rocky cliffs, and flinty knobs. These elevations, though far from being mountainous, nevertheless, afford views of the surrounding country, beautiful, extensive and in many instances, sublime. Again valleys intervene, through which meander some streams of water, bordered by alluvial bottoms and lofty forests. It was in such a country as this, to all appearance, that the Mastodon delighted to dwell, and there his bones are found most numerous.

"In one of the valleys named, just at the point where a fertile bottom is connected with a more elevated region, is a small saline marsh, perhaps of an acre in extent. One half of this marsh is covered by a soil different from that composing the marsh, but partaking of the character of a ridge of land, of one-eighth to one-fourth of a mile distant, and which runs parallel with the bottom abovenamed. This ridge is composed in part of a species of limestone, columns of which are at intervals left standing, and in some instances of from ten to twenty feet elevation above the surrounding portions of the ridge. Between this ridge and the marsh the ground declines gently, and was formerly covered with oak timber. It is now a cultivated field. The soil of this field also bears evidence of having been washed, or otherwise conveyed from the ridge. One-half of the marsh, as above stated, is covered with this soil, and to the extent of about ten feet. It was under this deposite, and to the depth of from two to twelve feet imbedded in the marsh, that these bones were found, lying in the greatest confusion and disorder. (Signed.) "S. H. Whipple"

(*Proceedings* 1847:35-36)

Further insight into the location of this locality is gained from Lay (1876:14) who states that:

"At an early day a large quantity of the bones of the mammoth, or mastodon, were found at two places in this County - one on the farm now owned by the Chas. Wickliff heirs, on the Osage; the other near the farm of Alexander Breshears, on the Big Pomme de Terre. At the Wickliff farm Messrs. Case and Redmond took out a large part, perhaps nearly the whole, of a large skeleton, shipped it to Cincinnati, I think, and obtained a large sum of money for it. One of the tusks is said to have been nine feet long. Others have obtained small quantities of bones at the same place. Drs. Sill & Crawford, a few years ago, took out some very interesting specimens, which they still have at their store."

In addition, O. P. Hay (1924:28) reported, regarding this Wickliff property, that "Mr. J. S. Kidwell, county surveyor of Benton County, has informed the writer [Hay] that the locality is in the southeast quarter of section 24, township 40, range 23 west...."

I have gone to some length here to provide a synopsis of that

which is currently known about the location of Whipple's early discoveries. While Lay makes no mention of Whipple in connection with the Wickliff farm, it is nevertheless most probable that this was the location Whipple described and from which he recovered the collection displayed and later sold at Philadelphia. (Lay mentions only two important locations, which Whipple's locality would have been, the Wickliff and Breshears farms, and we can with certainty exclude Whipple from any association with the latter as it had earlier been fully excavated by Koch.)

I have consulted the early Deed Record books in the Benton County courthouse to verify Kidwell's communication to Hay. The earliest reference to a Wickliff property is in 1839, when Isaac Wickliff purchased the NE $\frac{1}{4}$ , NW front S of Osage River, sec. 25, T.40N., R.23W. In 1842 this property was sold to a John Holloway, who resold it to the Wickliff family (John) in 1850. In 1858 Isaac Wickliff purchased the S $\frac{1}{2}$ NW $\frac{1}{4}$  sec. 30, T.40N., R.22W. Charles Wickliff first acquires property here in 1849, with the purchase of the N $\frac{1}{2}$ NW $\frac{1}{4}$  sec. 30, T.40N., R.22W. In 1850 he purchased the S part, SE $\frac{1}{4}$  sec. 24, T.40N., R.23W, which is the property noted to Hay by Kidwell. It is apparent that the Wickliff's were at least established in this area when Whipple was amassing his collection. I have not been able to ascertain which of these holdings were the property of the Charles Wickliff heirs in 1876, when Lay wrote (the family had a history of exchanging adjacent holdings among themselves), so must assume that any and all parcels could have been in the estate of this individual in 1876.

During the course of this field program, I have had ample

occasion to systematically survey, on foot, the entire area of the abovementioned holdings. Matching Whipple's description to presently extant topographic conditions feature by feature has not been possible, but Locality 3, discussed below under Site Specific Survey, herein considered to be his locality, is an agreeable compromise. In particular the hallmark of Whipple's description, the 10 - 20 foot limestone columns, were not relocated. If such ever existed in this region, and we cannot discount Whipple's description as being partially fanciful, they have long since been reduced to rubble or have been incorporated into domestic construction. Unlike Albert Koch, whose name and presence are securely attached to a fossil locality on the Pomme de Terre, and whose notebook descriptions led McMillan (1976) to the rediscovery of the former's 19th century fossil locality, Whipple was not a scientist, or even one particularly motivated toward systematic record keeping. Rather, Whipple was a very avid local land speculator, who stood to benefit profitably from embellished land descriptions. Such a professional modus operandi would result in colorful statements, such as the one quoted at length above, though this is quite simply my own speculation. Be this as it may, Locality 3, the much developed spring here called Old Tatge Farm Spring #3, does agree with the generalities of Whipple's description, particularly its occurrence "one half mile from the river Osage" in "a fertile bottom connected with a more elevated region ... one-eighth to one-fourth of a mile distant ..."

Strengthening this assumption is the recollection of Mr. Sam Robb (personal comm. 23 November 1976), of Warsaw, of tusks recovered here on display in a Warsaw drugstore forty years ago. This ties in well with the tradition of repeated discoveries noted by Lay, above, for the Wickliff locality. It is my strong feeling that Locality 3, Old Tatge Farm Spring #3, is the location of Whipple's original discoveries and rediscoveries, but the degree of certainty implied, in the absence of the limestone columns, can not be total.

I have endeavored to learn the present status of the Whipple and Case and Redmond materials. Whipple's collection is known to have been sold by 1847 to the American Philosophical Society of Philadelphia. The vertebrate paleontological collections of this institution have since been transferred to the Academy of Natural Sciences of Philadelphia. Correspondence with Dr. David Gillette of the latter institution (personal comm. 6 March 1975) indicate that there are numerous vertebrate fossils from Benton County in their collections. Some of these are certainly Whipple's collection; however, without other information at hand at this writing, portions of the Benton County collection may be from Koch's 1840 Pomme de Terre River excavations (see below).

Correspondence with Cincinnati institutions has not been as rewarding. If Case and Redmond did indeed excavate and transfer specimens from Whipple's locality to Cincinnati (*fide* Lay 1876:14) they most probably were directed to the Cincinnati Museum of

Natural History (CMNH). I have been informed by Mr. R. A. Davis, paleontologist and Director of Science Education (personal comm. 7 October 1976) at that institution that their collections contain no Benton County fossils. Mr. Davis did state, however, that most of the CMNH fossil collection was given to the University of Cincinnati Geology Museum some decades ago. A letter from Dr. David Meyer, Curator of the Geology Museum, (personal comm. 16 November 1976) informed me that the only portion of this transfer which could possibly be from Missouri are the skull and jaws of a young mastodon which lack label or number. However, such remains do not agree with those reported by Lay (1876:14), who states that Case and Redmond excavated "a large part ... of a large skeleton ...." I conclude that any Benton County materials sent to Cincinnati have been subsequently lost.

The Koch Site (MGSQV 1001), in Hickory County, was excavated by Albert C. Koch of St. Louis in 1840 (in Koch's day Hickory County was still the southern portion of Benton County). Koch recovered the remains of numerous *Mammot americanum*, associated with, according to Harlan (1843), the remains of ox, deer, elk and sloth. Koch dispersed this collection here and abroad, with much of the *Mammot* material sold to the British Museum. Lydekker (1886: 16-27) lists 92 specimens, in addition to the skeleton of "*Missourium*" reassembled as *Mastodon americanus*, as being "from Missouri" and purchased "about 1844." This still leaves much of Koch's Pomme de Terre collection unaccounted for, though much of

this may be included among the materials from Benton County in the Academy of Natural Sciences in Philadelphia. I examined the Koch materials in London in September of 1977 and my assessment of them follows in the next section.

Kirby Spring (see King 1975) is, according to local inhabitants of the area, the site of Koch's former activities. McMillan (1976), however, has shown that local tradition in this case is in error. Kirby Spring is currently a large marsh within a shallow basin rimmed by disturbed sediments. It is one of several, possibly many, Ozark springs extensively quarried for mastodon bones during the pre-Civil War "bone rush" generated by Koch's successes in 1840. This spring was tested in 1971, but no identifiable faunal remains were encountered. The backdirt piles surrounding the spring contain bone and tusk fragments which attest to the former occurrence of proboscideans. Nothing else is known as to what may have been recovered from this spring, or where its present reposit may be.

The Koch collection. The bulk of the British collection of Koch material is currently stored in the Department of Paleontology of the British Museum (Natural History). Portions of the Koch purchase, most notably the altered skeleton of "*Missourium*", are exhibited in the museum's galleries. The department's records show that other portions have been dispersed to other institutions or individuals in Britain, notably provincial museums. Nevertheless, the catalogue of the collection as originally received shows



that many Koch specimens can not be accounted for today and are presumably lost or destroyed. All Koch specimens are registered as "North America. Purchased of Mr. Koch." Contrary to Lydekker's catalogue (1886), which is, surprisingly, incomplete, the Koch collection is extensive, in spite of attrition.

The following discussion is not to be construed as a study; it is rather an assessment of the collection, followed by a brief synopsis of what may be learned from its study. It is my intent, however, to fully describe the materials and to publish a study of the Koch collection in the near future. The specimens discussed below will form the basis for this study.

The Koch collection in the British Museum (Natural History) includes 182 specimens, ranging from an assembled skeleton to isolated small bones and teeth, all referable to *Mammot americanum*, the American mastodon. The collection represents a minimum of 19 individuals, ranging in age from very young to very old, based on the occurrence of: 1) 2 right upper 2nd deciduous premolars ( $rdP^2$ ), 2) 17 right upper 2nd molars ( $rM^2$ ), including the altered skeleton of "*Missourium*". Because it is not possible for a single animal to retain both  $rdP^2$  and  $rM^2$  simultaneously, the dental materials must represent a minimum of 19 individuals.

Exclusive of the altered skeleton of "*Missourium*", the collection includes 12 upper tusks, of which one is *in situ* in a skull; the other 11 are isolated and are, with 2 exceptions, incomplete. There are 20 incomplete crania containing 38 teeth *in situ*; one of

the crania, though incomplete, is much better preserved than the others, lacking only the cranial vault, right tusk and the right upper second molar. There are 19 complete and incomplete mandibles containing 55 teeth *in situ*; one mandible retains a tusk on the right side. Finally, there are 63 isolated teeth, including 43 upper and 20 lower specimens. In sum, there are 156 teeth in the collection, exclusive of those in the altered skeleton of "*Missourium*". Of these, 81 are upper series teeth and 75 are lower series teeth; 89 are of the right side and 65 are of the left side and 2 are indeterminable.

The altered skeleton of "*Missourium*" is currently a standing mount exhibited in the museum's galleries (Figure 2). It bears the modifications of several restorations, the first being the initial alteration conducted by Sir Richard Owen subsequent to purchase in 1843 and the last conducted subsequent to World War II (Mr. Jeremy Hooker, British Museum [Natural History] personal comm. September 1977). For this reason the specimen is heavily restored, but it does carry the original dentition, consisting of the 2nd and 3rd molars of the right and left side, both upper and lower series (a total of 8 teeth).

There are 68 additional bones in the collection; they do not require lengthy discussion here. It is interesting to note nevertheless, that the central bodies of 5 thoracic, 2 lumbar and 4 caudal vertebrae bear drilled perforations, as do 4 of the phalanges and the one indeterminable bone (Figure 3 illustrates



Figure 2. The altered skeleton of "Missourium" (*Mammot americanum*) as currently exhibited in the British Museum (Natural History), London.

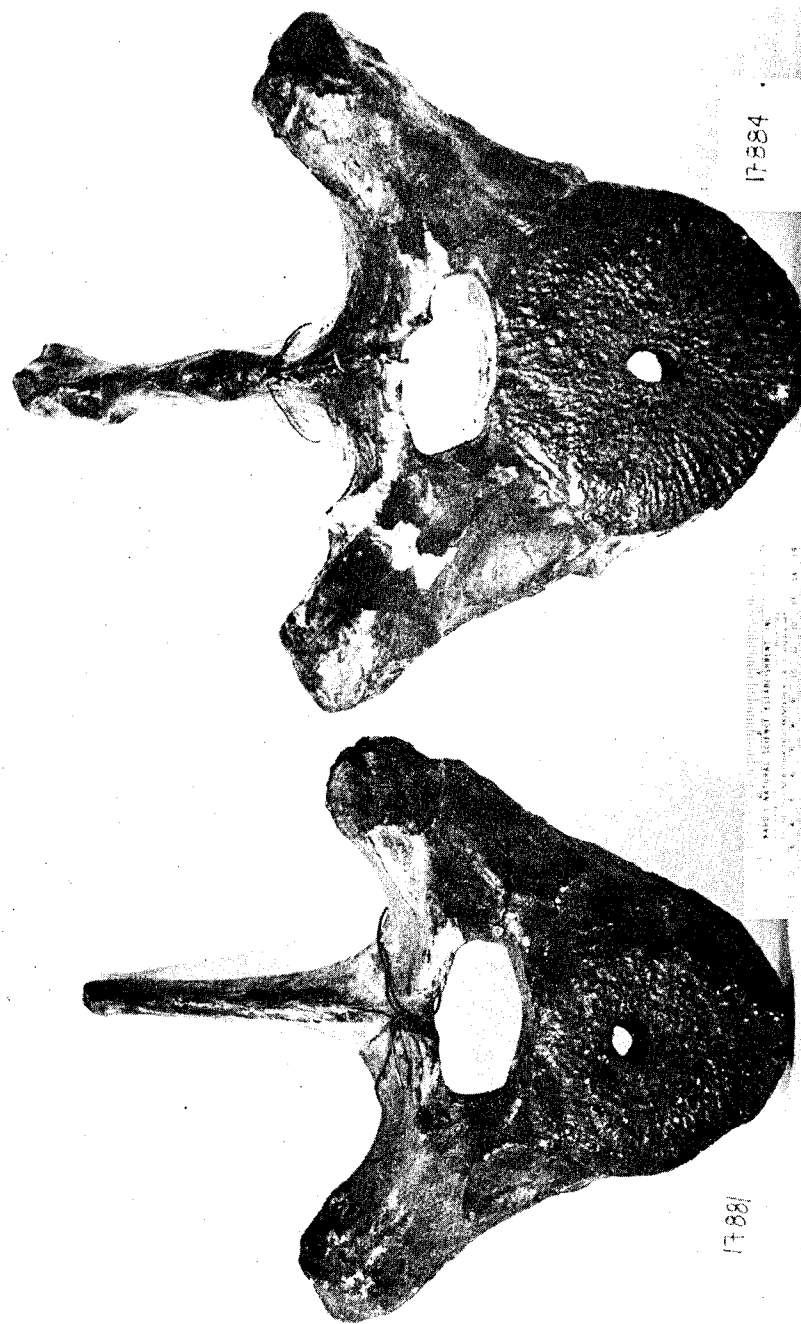


Figure 3. Perforated thoracic vertebrae from "Missourium" (*Mammut americanum*).

examples). I infer that these specimens were removed in the altering of "*Missourium*" after its purchase in 1843 and that the holes were drilled by Koch or his workers in 1840 when "*Missourium*" was being assembled in St. Louis. It has been mentioned by contemporary observers, most notably by Goddard (1841) that "*Missourium*" had the appearance of a lengthened mastodon bearing splayed feet (to suggest webbed toes) and moustache-like tusks (to imply additional uniqueness). The drilled specimens are exactly those which would impart the lengthening (the vertebrae) and splaying (phalanges).

Measurements and observations which I recorded from these materials in September, 1977, will enable a complete analysis of the Koch mastodons, and will, more importantly, provide for the integration of this assemblage into the framework of past and current research (see below). During my examination of the Koch collection I collected sediment matrix samples which are currently being analyzed for pollen content. It is known that Koch collected extensively from three, possibly four, localities in Missouri: 1) Bourbeuse River in Gasconade County, 2) Kimmswick in Jefferson County, 3) Koch Spring in Hickory County and, possibly, 4) Kirby Spring in Hickory County (McMillan 1976:83-89). Pollen analysis may resolve which of these localities are represented among the Koch materials in the British Museum (Natural History).

Localities of current research. It remains to be mentioned that fossil assemblages from Boney Spring, Jones Spring and

Trolinger Spring are foci of current research. I have analyzed and described the diverse Pleistocene faunal assemblage recovered in 1968 and 1971 from Boney Spring as well as the available fauna from Trolinger Spring (Saunders 1977). I am currently the Principal Investigator of a contract providing for full recovery and analysis of Pleistocene fossil remains from Jones and Trolinger springs. This contract calls for full analysis and publication of results subsequent to completion in 1980.

#### Site Specific Survey

Method. Within vertebrate paleontology there exists no general theory or method of systematic sampling or survey, and the survey results reported here have been derived without the aid of established precedence. This is in sharp contrast to archaeology, a discipline where sampling theory is well developed as a sub-discipline (Mueller 1975). In lieu of a methodological precedence in vertebrate paleontology, I have had recourse to the literature reporting the results of archaeological surveys conducted prior to the recent infusion of sampling theory, and have abstracted a workable methodology from that source. For example, Roberts (1952), in a River Basin Survey report, states (p. 352) that "on the basis of information available in published reports, from correspondence with local societies, ... and interested laymen, areas where surveys should be started were determined." This has been the procedural precept utilized in the present survey. I have modified

it somewhat, for example to include local newspaper advertisements, but nevertheless consider Roberts' method viable for the present survey.

Survey results. A list of all sites field checked and a map of their locations is presented below. This survey was confined to the search for, and assessment of, spring sites for several reasons, including 1) the well established fact that spring deposits in the project area contain important fossil accumulations, 2) the persistence of springs, or their traces, at the earth's surface for long periods of time, 3) the abundance of springs in the project area and 4) the prevalence of springs in bottomland terrace deposits, which facilitates their discovery. Fossil vertebrates are also known in considerable abundance from solution cavities (caves, sinks and fissures) in the Ozark Plateaus, but solution cavities were not considered in this survey for several reasons, including 1) the absence of fossil faunas from such features in the project area, 2) the transient existence of solution cavities at the earth's surface, and 3) the infrequent occurrences of solution cavities in the project area. In this regard, I believe it significant that, during the field program, only one cave occurring in the impoundment area was brought to my attention; it has not, however, been field checked.

Each spring or possible spring site field checked and/or tested during the course of this survey is discussed below. The spring sites are arbitrarily numbered 1 - 19 on the basis of discovery priority and are discussed in sequence. In addition, the

number keys the spring site to its location on the map (Figure 1), which includes, for purposes of completeness, the results of an earlier survey in the Pomme de Terre valley conducted and reported by King (1975) and reproduced here with his permission. Included for each spring or possible spring site is the following: 1) local name(s), either traditional or herein contrived, 2) location on United States Geological Survey 7.5' quadrangle series of most recent date, 3) elevation in meters, followed by equivalent English unit in parentheses, and 4) remarks, which include a description of the location, a brief description of the recovered materials, a discussion of the locality's relative importance, and recommendations for further work, if any, or for preservation.

1. Old Tatge Farm Spring #1. Extreme SW $\frac{1}{4}$ SW $\frac{1}{4}$ SW $\frac{1}{4}$  sec. 19, T.40N., R.22W.; Warsaw West 7.5' Quad. (1965). Benton County, Missouri. Elevation: 206m (680ft). A flowing (developed) artesian spring with marsh, forming a surface depression approximately 20m (66ft) in diameter. TESTED - sequence encountered in marsh:

- 1) 0.3m (1ft) of dark brown organic detritus with silt and clay,
- 2) 2.1m (7ft) of reddish-gray mixed gravel colluvium. No evidence of Pleistocene biotic accumulation.

2. Old Tatge Farm Spring #2. Extreme SE $\frac{1}{4}$ SE $\frac{1}{4}$ SE $\frac{1}{4}$  sec. 24, T.40N., R.23W.; Warsaw West 7.5' Quad. (1965). Benton County, Missouri. Elevation: 206m (680ft). A bottomland depression with dark organic soils, approximately 30 m (100ft) long and 10m (33ft) wide. TESTED - sequence encountered: 1) 0.5m (1.7ft) of dark



brown organic detritus with silt and clay, 2) 1.0m (3.3ft) of red-dish-gray clayey mixed gravel alluvium, 3) 1.5m (5ft) of red-mottled gray plastic clay. No evidence of Pleistocene biotic accumulation.

3. Old Tatge Farm Spring #3. (?Tackner, ?Warsaw Swamp, ?Wickliff farm). ~~N<sub>2</sub>E<sub>1</sub>NE<sub>1</sub>~~ sec. 25, T.40N., R.23W.; Warsaw West 7.5' Quad. (1965). Benton County, Missouri. Elevation: 205m (675ft). A developed, probably artesian, spring, with sub-surface water source, forming a large farm pond, with effluent discharging west toward the Osage River. Mr. Sam Robb, Warsaw, Missouri, remembers viewing proboscidean tusks recovered here displayed during the 1930's in a Warsaw drugstore (personal comm. 23 November 1976). Of the several springs on the old Tatge farm (whose boundaries coincide with those of the Isaac Wickliff farm of the last century) this locality most likely is Tackner (Warsaw Swamp as well as Wickliff farm) of earlier literature references (Lay 1876, Hay 1924, etc.).

4. Kinkead Spring #1. ~~NE<sub>1</sub>SW<sub>1</sub>SE<sub>1</sub>~~ sec. 25, T.41N., R.23W.; Shawnee Bend 7.5' Quad. (1959). Benton County, Missouri. Elevation: 209m (690ft). A tiled spring, possibly lateral seepage, possibly artesian, located on the homestead developed by Mr. E. B. Kinkead's great grandfather in 1832 (Mr. E. B. Kinkead, Warsaw, Missouri, personal comm. 26 November 1976; Lay (1876:18) states that "in 1832 Milton Kincaid ... bought out an Indian clearing and wigwams" on Little Tebo, giving the Indian \$9.00).

5. Kinkead Spring #2. ~~NE<sub>1</sub>SE<sub>1</sub>NE<sub>1</sub>~~ sec. 35, T.41N., R.23W.;

Shawnee Bend 7.5' Quad. (1959). Benton County, Missouri. Elevation: 203m (670ft). According to Mr. E. B. Kinkead (personal comm. 26 November 1976), there is a "freshwater" (as opposed to "sulphur") spring at this location. Not located during field program.

6. Black Sulphur Springs. ~~NW 1/4~~ sec. 35, T.41N., R.23W.; Shawnee Bend 7.5' Quad. (1959). Benton County, Missouri. Elevation: 200m (660ft). A large, spring-fed slough with a silted outlet formed after the filling of Lake of the Ozarks behind Bagnell Dam. Mr. E. B. Kinkead (personal comm. 26 November 1976) stated that previously 3 artesian sulphur springs, in SW-NE alignment, discharged onto the surface and followed a common run to the South Grand River. He further stated that the NE locus was the most active, the other two less so, though all discharged even during the most severe years. In addition, he noted that a fourth, "freshwater", spring occurs here as well; these four loci are collectively called Black Sulphur Springs. This spring locality could not be tested because of standing water problem.

7. White Sulphur Springs. ~~SW 1/4~~ sec. 32, T.40N., R.23W.; Valhalla 7.5' Quad. (1941). Benton County, Missouri. Elevation: 202m (665ft). An extensive marsh area with effluent run fed by two artesian spring loci issuing through poorly sorted clastic feeder complexes. TESTED - sequence encountered: 1) 0.32m (1ft) of brown peaty clay with sand and gravel, 2) 0.08m (0.3ft) of oxidized medium gravels, 3) 0.20 (0.7ft) of medium gray blocky clay

with sands and gravels, 4) 0.04m (0.1ft) of charcoal-stained gravels, 5) 0.06m (0.2ft) of rusty red clay with mixed sand and gravel, 6) 0.20m (0.7ft) of gray clay mixed with coarse brown chert gravel, 7) 0.25m (0.8ft) of light gray clay with fine gravel, 8) 0.85m (3ft) of mixed gravelly gray clay (fossiliferous), 9) 0.20+m (0.7+ft) of gray gravel with water at base. Proboscidean bone fragments and the root of a mastodon cheek tooth were recovered at a depth of approximately 1.6m (5.3ft) in a gray mixed gravelly clay alluvium on 18 January 1977 (Figure 4). Additional testing on 12 April 1977 recovered more proboscidean bone fragments as well as the symphysis of a human mandible. The human material has been transferred to the HST Cultural Resources Survey, University of Missouri, Columbia. Archaeological site forms have been completed and returned with the specimen.

8. Berry Spring. Extreme S $\frac{1}{4}$ S $\frac{1}{4}$ NW $\frac{1}{4}$  sec. 1, T.39N., R.24W.; Valhalla 7.5' Quad. (1941). St. Clair County, Missouri. Elevation: 206m (680ft). A 0.15m (6in) artesian head issues through a 0.2m (8in) diameter well casing set in bedrock at the head of a spring branch at this locality. The branch has eroded to bedrock and there is no marsh development.

9. Bell Island Ford Spring. NE $\frac{1}{4}$ SW $\frac{1}{4}$ NE $\frac{1}{4}$  sec. 28, T.40N., R. 23W.; Warsaw West 7.5' Quad. (1965). Benton County, Missouri. Elevation: 209m (690ft). Lateral seepage is collected into a concrete sump and forms an adjacent marsh approximately 10m (33ft) in diameter, discharging thence into a farm pond. TESTED -

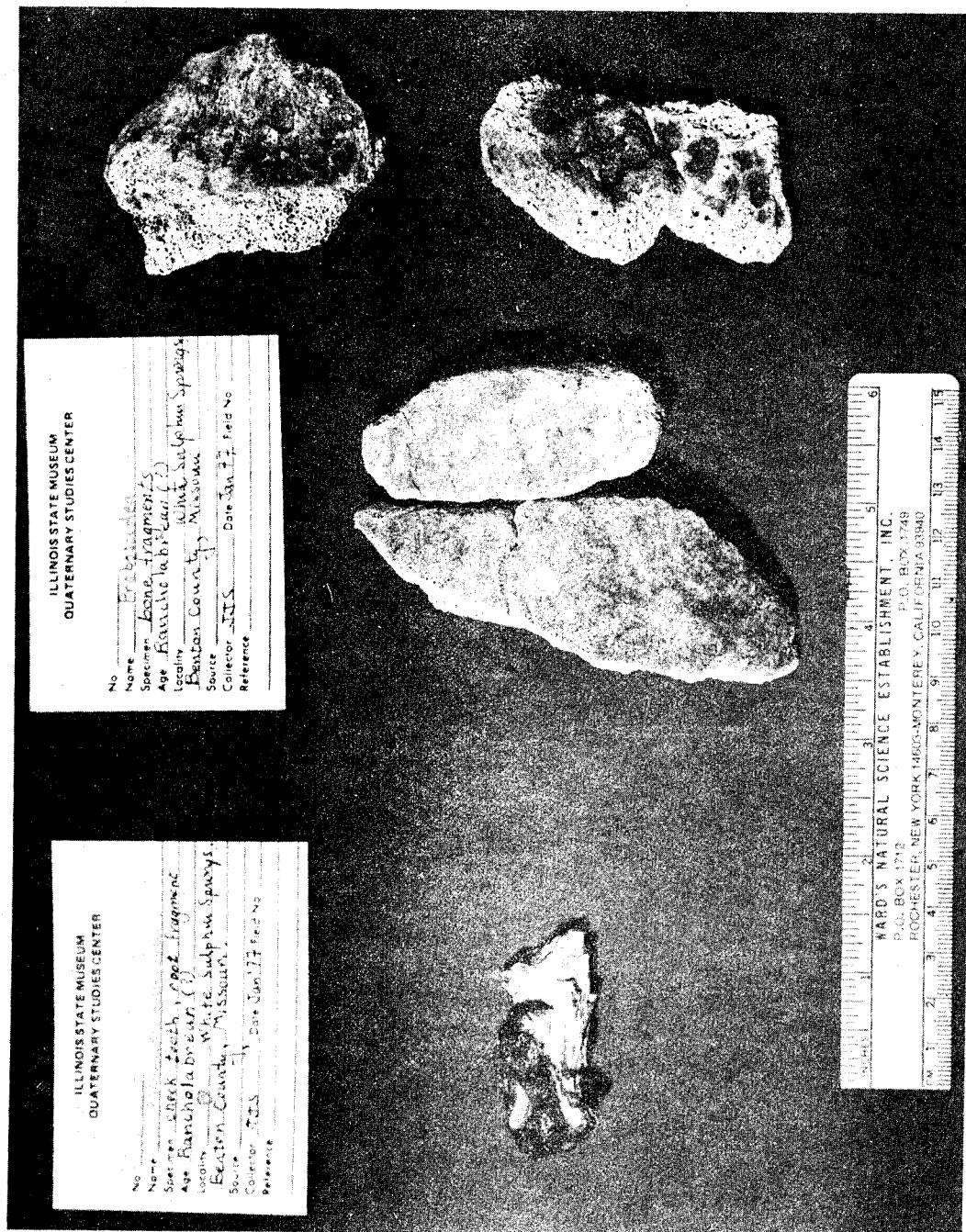


Figure 4. Fossil remains from White Sulphur Springs, Benton County, Missouri.

sequence encountered: 1) 0.4m (1.3ft) of dark brown organic detritus, with silt and clay, 2) 2m (6.6ft) of uniformly reddish-gray clayey mixed gravel colluvium, 3) bedrock (Jefferson City dolomite). No evidence of Pleistocene biotic accumulation.

10. Loren Martin Spring. C of SE $\frac{1}{4}$ SE $\frac{1}{4}$  sec. 30, T.40N., R.22W.; Warsaw West 7.5' Quad. (1965). Benton County, Missouri. Elevation: 218m (720ft). According to Mr. Loren Martin, Warsaw, Missouri (personal comm. 11 April 1977) this locality is a hand dug well dating from 1901 and maintained to this day. Probably a developed spring.

11. Fielas Crawford Spring. N $\frac{1}{2}$ S $\frac{1}{2}$ NE $\frac{1}{4}$  sec. 1, T.39N., R.23W.; Warsaw West 7.5' Quad. (1965). Benton County, Missouri. Elevation: 203m (670ft). Wet bottomland depression with dark organic soils, approximately 30m (100ft) in diameter. TESTED - sequence encountered: 1) approximately 0.5m (1.7ft) of dark brown silty clay with organic detritus, 2) 3.5m (12ft) of dark gray peaty clay. No subsurface water source encountered. At 2.4 - 2.7m (8-9ft) we recovered the partial remains of an aboriginal interment; this information and material has been transferred to the HST Cultural Resources Survey, University of Missouri, Columbia. No evidence of Pleistocene biotic accumulation.

12. Cul-de-Sac Spring. S $\frac{1}{2}$ N $\frac{1}{2}$ NE $\frac{1}{4}$  sec. 1, T.39N., R.23W.; Warsaw West 7.5' Quad. (1965). Benton County, Missouri. Elevation: 209m (690ft). Natural seepage from horizontal bedrock fissures has produced an extensive pond with only shallow organic deposits at this locality.

13. Ballet Cemetery Spring (Balliette Cemetery Spring).

SW $\frac{1}{4}$ NW $\frac{1}{4}$ SW $\frac{1}{4}$  sec. 19, T.40N., R.22W.; Warsaw West 7.5' Quad. (1965). Benton County, Missouri. Elevation: 203m (670ft). A 0.15m (6in) steel casing rising 0.5m (18in) out of bedrock sustains a slight artesian flow accumulating in a small (1.5m = 5ft diameter) and shallow (0.3m = 1ft deep) bedrock basin containing an accumulation of modern debris.

14. Little White Sulphur Spring. Extreme NW $\frac{1}{4}$ NE $\frac{1}{4}$  sec. 1,

T.39N., R.24W.; Valhalla 7.5' Quad. (1941). St. Clair County, Missouri. Elevation: 205m (675ft). A spring-fed open pool in the bottom of a small branch draining northward to the Osage River.

TESTED - sequence encountered: 1) approximately 0.5m (1.7ft) of buff silt and clay, 2) 0.5m (1.7ft) of brown silty organic clay containing modern refuse, 3) approximately 1.0m (3.3ft) of light brownish-gray peaty clay containing abundant plant remains, 4) 1(+m (3.3+ft) of gray coarse sand and mixed gravel colluvium representing the subsurface source of discharge. A chert adze

and thinned chert biface were recovered from the aquifer gravel; this material and information has been transferred to the HST

Cultural Resources Survey, University of Missouri, Columbia.

Several deer bones, possibly Recent, of unestablished context were recovered. Twenty-seven kg (60lbs) of the peaty clay stratum was collected for pollen analysis, wet screen washing and radiocarbon age determination.

15. Springstude Marsh. SW $\frac{1}{4}$ SE $\frac{1}{4}$ NE $\frac{1}{4}$  sec. 10, T.38N., R.25W.;

Osceola 7.5' Quad. (1939). St. Clair County, Missouri. Elevation: 212m (700ft). A bottomland depression with dark organic soils, approximately 100m (330ft) long and 10 - 20m (33 - 66ft) wide. TESTED - sequence encountered: 1) approximately 0.1m (0.3ft) of dark brown silty clay with organic detritus, 2) 3m (10ft) of dark gray clay containing a snail shell concentration near top, 3) 1(+ )m (3.3+ft) of light brown friable clay. No subsurface water source encountered. No evidence of Pleistocene biotic accumulation.

16. Magnolia Springs. NW<sub>4</sub>SW<sub>4</sub>NW<sub>4</sub> sec. 27, T.38N., R26W.; Monegaw Springs 7.5' Quad. (1938). St. Clair County, Missouri. Elevation: 212m (700ft). Lateral seepage from three separate but adjacent bedrock loci, producing small (approximately 1.5m = 5ft diameter) and shallow (approximately 0.6m = 2ft deep) marshes occupying bedrock basins.

17. Monegaw Springs. E<sub>2</sub>SW<sub>4</sub>NW<sub>4</sub> sec. 30, T.38N., R.26W.; Monegaw Springs 7.5' Quad. (1938). St. Clair County, Missouri. Elevation: 212m (700ft). Numerous artesian sulphur springs discharge adjacent to Little Monegaw Creek at this location. Local tradition maintains that there are 102 springs within a 90m<sup>2</sup> (100yds<sup>2</sup>) area, each characterized by a discharge with unique properties (Mr. Ike Parker, Clinton, Missouri, personal comm. 25 March 1977). Right of access had not yet been obtained by the Corps of Engineers on this date and this locality was not tested. Mineral-charged spring waters today attract numerous animals, as

they did undoubtedly in the past. Should the government acquire this property, it is recommended that the springs be tested for fossil remains.

18. Clinton Spring Pond. SW $\frac{1}{4}$ SW $\frac{1}{4}$ NE $\frac{1}{4}$  sec. 27, T.41N., R.26W.; Clinton South 7.5' Quad. (1953). Henry County, Missouri. Elevation: 215m (710ft). A developed farm pond, possibly spring-fed, occupies a depression at this locality.

19. Black Leg Spring. SW $\frac{1}{4}$ NW $\frac{1}{4}$ SE $\frac{1}{4}$  sec. 32, T.40N., R.23W.; Warsaw West 7.5' Quad. (1965). Benton County, Missouri. Elevation: 206m (680ft). Lateral seepage from closely adjacent bedrock bluffs is gathered in a ceramic tile and gravity-fed into a concrete cistern which overflows to (partially) sustain an extensive marsh at this locality. TESTED - sequence encountered: 1) 0.8m (2.6ft) of dark brown silty clay with organic detritus, 2) 0.8m (2.6ft) of gray coarse chert gravel colluvium, 3) bedrock. No evidence of Pleistocene biotic accumulation.

Table 2 summarizes the results of this survey. Of the 19 spring or possible spring sites located in this survey and listed above, 8 (Localities 1, 2, 7, 9, 11, 14, 15, 19; = 42%), judged to have the greatest potential for containing Pleistocene remains (based on geological setting, magnitude and inferred duration of discharge, gross chemical properties of the discharge, as well as those intangible evoked responses termed, simply, "gut feeling") were tested with a tractor-mounted backhoe. Of those tested, a single spring (Locality 7; = 5% of the total sample) was found to



TABLE 2. Summary of survey results by spring locality.

Spring	Tested	Nil	Animal Remains	Human Remains	Artifacts
1. Old Tatge Farm Spring #1	X	X			
2. Old Tatge Farm Spring #2	X	X			
3. Old Tatge Farm Spring #3					
4. Kinkead Spring #1					
5. Kinkead Spring #2					
6. Black Sulphur Springs					
7. White Sulphur Springs	X		F	?R	
8. Berry Spring					
9. Bell Island Ford Spring	X	X			
10. Loren Martin Spring					
11. Fielas Crawford Spring	X			?R	
12. Cul-de-Sac Spring					
13. Ballet Cemetery Spring					
14. Little White Sulphur Spring	X		?R		X
15. Springstude Marsh	X	X			
16. Magnolia Springs					
17. Monegaw Springs					
18. Clinton Spring Pond					
19. Black Leg Spring	X	X			

## Symbols:

R = Recent

F = Fossil

contain Pleistocene vertebrate remains. Another spring (Locality 3), which was not tested, nevertheless is here considered to contain, or to have contained, Pleistocene vertebrate remains. All indications are that the latter locality is the Tackner, Warsaw Swamp as well as Wickliff farm locality of earlier literature references (Lay 1876, Hay 1924). In addition, 3 of the tested sample (Localities 7, 11 and 14; = 16% of the total sample) were found to contain probably Recent traces of human activity, including artifacts (Locality 14) and portions of probable burials (Localities 7 and 11). Locality 7, included here, also contains Pleistocene vertebrate remains and thus the possibility of a genuine Pleistocene association cannot be disregarded based on the data compiled during this survey. Finally, only one of the tested sample (Locality 14; = 5% of the total sample) contained a significantly well developed organic stratum, judged, on the absence of proboscidean remains, to be Holocene in age.

Assessment of survey results. Of the tested sample, three localities (Numbers 7, 11 and 14) require additional comment.

White Sulphur Springs (Locality 7) was subjected to the most extensive testing employed during the field program. While fragments of proboscidean bones, a root fragment of a mastodon tooth, as well as a portion of a human mandible were recovered, no concentration of organic remains was encountered. It is the expressed feeling of this writer that the fossil remains occur as isolated clasts (though as possibly complete specimens) within the coarse

sediments and that they do not imply the existence of a significant Pleistocene faunal deposit. The spring deposits tested bore evidence of many and diverse modern developments (e.g., pilings of a pavilion were discovered to penetrate to a depth of 1.5m (=5ft) into the spring deposits) and the human mandible fragment, though possibly of some antiquity, is most probably interpreted as an intrusive, fortuitous association with probably extrusive, secondarily deposited Pleistocene vertebrate remains. Additional paleontological work does not seem to be warranted.

Fielas Crawford Spring (Locality 11) and Little White Sulphur Spring (Locality 4) do not contain evidence of Pleistocene biotic remains. Both do, however, contain traces of Holocene human activity. While I cannot assess the true significance of these materials, I can recommend them to those properly trained to do so. In light of past experience which has shown that aboriginal man utilized spring sites in the Pomme de Terre valley (Bass and McMillan 1973, King and McMillan 1975) it seems advisable that these spring sites and materials be considered for assessment in the HST cultural resources survey.

Recommendations. Due to presently prevailing conditions, three potentially important spring sites visited during this field program could not be tested.

Monegaw Springs (Locality 17), in the southwestern portion of the impoundment area, is on as yet unaccessioned property. If, during the course of completion of the HST project, this property

is acquired by the government and right of access gained, this area should be subjected to an extensive testing program.

Black Sulphur Springs (Locality 6) is presently an extensive slough adjacent to the left bank of the South Grand River. Testing of this potentially important locality is possible but would involve extensive modification of its outlet at the South Grand River, followed by a period of drying. Such would require a more ambitious program, in terms of manpower and time investment, than the one employed herein. In view of the difficulty of following up initial testing with a viable excavation program, it is recommended that testing not be attempted.

Old Tatge Farm Spring #3 (Locality 3) is presently a developed farm pond. In view of the fair certainty that it represents the site of earlier important recoveries, this spring, too, should be properly tested. This would also require extensive outlet modification with an ambitious investment in time and manpower. It could, however, settle for once and for all, whether this is indeed the locality of Whipple's discoveries.

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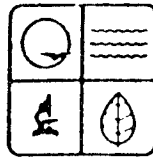
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APPENDIX A  
REVIEWER'S COMMENTS

JOSEPH P. TEASDALE  
GOVERNOR



42  
CAROLYN ASHFORD  
DIRECTOR

## missouri department of natural resources

P.O. Box 176

Jefferson City, Missouri 65101

314/751-4422

June 7, 1977

Mr. Paul D. Barber  
Chief, Engineering Division  
U.S. Army Corps of Engineers  
Kansas City District  
700 Federal Building  
Kansas City, Missouri 64106

Re: Draft Report Entitled "Paleontological Resource Survey: Tebo, South Grand and Osage Arms, Harry S. Truman Dam and Reservoir, Osage River Basin, Missouri"

Dear Mr. Barber:

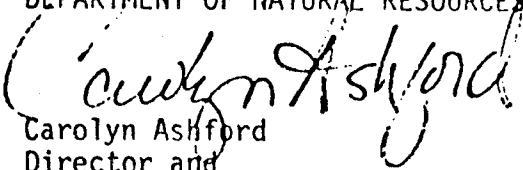
The Office of Historic Preservation staff has reviewed the above referenced draft report and has found it to be thorough and well done. However, we would like to offer the following comments:

1. We agree with the investigator's recommendations as outlined on pp.25-26 of the report. We suggest that the testing program recommended should be initiated as soon as possible.
2. The Office of Historic Preservation should be provided with U.S.G.S. 7 1/2 min. maps indicating the location of all spring sites discussed within the report to the proposed project. In addition, copies of all pertinent site records should be provided to our office. This information is necessary for the effective planning and management of Missouri's resource base.

If my staff or I can be of further assistance, let me know.

Sincerely,

DEPARTMENT OF NATURAL RESOURCES

  
Carolyn Ashford  
Director and  
State Historic Preservation Officer

CA:mwm

Regarding the suggestions and comments of Ms. Carolyn Ashford, Director, Missouri Department of Natural Resources:

Comment 1: Additional testing should not be attempted this winter (1977/1978), based on my past experiences. Testing could be renewed during the spring of 1978, however, filling schedule permitting.

Comment 2: I have included pertinent site records (completed HARRY S. TRUMAN RESERVOIR ARCHAEOLOGICAL SURVEY site report forms) with the letter of transmittal to The Department of the Army, Corps of Engineers, Kansas City District, with the understanding that they would be forwarded to other state and federal agencies.



# United States Department of the Interior

## NATIONAL PARK SERVICE

INTERAGENCY ARCHEOLOGICAL SERVICES - DENVER  
OFFICE OF ARCHEOLOGY AND HISTORIC PRESERVATION

1978 SOUTH GARRISON - ROOM 107

DENVER, COLORADO 80227

IN REPLY REFER TO:

H2219-(RMR)PI

JUL 11 1977

Mr. Paul D. Barber  
Chief, Engineering Division  
U. S. Army Corps of Engineers  
Kansas City District  
700 Federal Building  
Kansas City, Missouri 64106

Attention: Roberta Comstock

Dear Mr. Barber:

We have reviewed these reports at your request and our staff offers the following comments on each.

"Cultural Resources Survey of Smithville Lake, Missouri: Volume I: Archeology" by Patricia J. O'Brien. Our staff found this to be a fairly good descriptive report that will be readily utilizable for comparative purposes by other archeologists once the illustrations are included in the final report. In some cases, however, Dr. O'Brien appears to have good ideas but she often does not develop her arguments or present her conclusions in a logical and orderly manner.

Dr. O'Brien's summary and evaluations of the importance of several sites in the reservoir area would appear to meet the criteria for consideration for nomination to the National Register of Historic Places. However, this should be more fully detailed so the Corps can seek determination of eligibility or nomination of these threatened sites to the Register.

"Cultural Resources Survey of Smithville Lake, Missouri: Volume II: History" by Dennis Shockley. We were somewhat handicapped in the preparation of this review as we did not have the Scope-of-Work. Thus, we cannot say exactly what was expected of the author. However, reviewing this report as a straight historical essay, we find that it has a number of problems. Generally speaking, the report has no theoretical framework, no central theme, and makes no cogent points. The introduction to the report states that the emphasis is placed on economic



forces at work in the area. In the body of the report, these concerns are largely ignored except on the most extreme simplistic level. Demography is totally ignored in this study.

Linderer's (Volume III below) and Synhorst's (Volume II below) studies are far more detailed and, therefore, more likely to yield information more useful for professional inquiry and culture resource planning.

The historic sites survey forms do not convey a great deal of information. There are no location maps or any sketch maps of the sites. There are no photographs, no descriptions of artifacts found with the sites, and the descriptions of physical remains are so general as to be almost useless. Finally, there are no National Register nominations.

This report appears to need a great deal of work to bring it up to usable professional standards.

"Archeological Test Excavations in the Harry S. Truman Reservoir, Missouri: 1975" by Stephen A. Chomko. All in all, this seems to be a fairly competent descriptive report. Data are presented in an adequate, if uninspired manner. The inclusion of a larger number of artifact illustrations would enhance its utility, but the material presented in the report can be quite easily used for comparative purposes by other archeologists.

"Paleontological Resources Survey: Tebo, South Grand and Osage Arms, Harry S. Truman Dam and Reservoir, Osage River Basin, Missouri" by Jeffrey J. Saunders. This report appears to be well done. It could use a chart itemizing all finds by spring. In addition, the specimens recovered should be described in more detail.

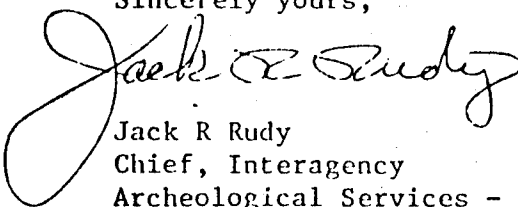
"Cultural Resources Survey, Harry S. Truman Dam and Reservoir Project, Volume III, Architectural Survey" by Nanette M. Linderer. For the most part, this report seems to be very well done with the buildings competently described and divided into logical and useful types. Near the beginning of the report, the author states that houses and barns are concentrated on in the text because they were most heavily influenced by cultural and environmental factors (p. 18). However, what cultural and environmental factors affect the architecture are never discussed. This information as well as more on the developments of styles and history of the architecture in the area would enhance the report's value. Sample floor plans for the house types would make their descriptions much clearer. Photographs and drawings are very poorly reproduced and are therefore of very limited utility.

"Cultural Resources Survey, Harry S. Truman Dam and Reservoir Project, Historical Resources, Volume II: Historical Gazetteer and Mitigation Recommendations" by Curtis H. Synhorst. The historical Gazetteer in this

report appears to be an excellent and useful piece of work. The mitigation statement that is offered needs to be reworked. The recommendations that are given are rather diaphanous and should deal with specific sites projects, and problems. No real consideration is given to National Register nominations.

If we can be of any further assistance to you, please contact us.

Sincerely yours,

A handwritten signature in cursive script, reading "Jack R. Rudy". The signature is written in dark ink and is positioned above the typed name and title.

Jack R Rudy  
Chief, Interagency  
Archeological Services - Denver

Regarding the suggestions and comments of the staff of Mr.  
Jack R. Rudy, Chief, Interagency Archaeological Services, National  
Park Service - Denver:

Letter of July 11, 1977, pg. 2, paragraph 6, lines 3 and 4:  
see my report, Table 2, page 33.

Letter of July 11, 1977, pg. 2, paragraph 6, lines 4 and 5:  
see my report, Figure 4, page 28; this should make clear that more  
detailed description is not possible.

APPENDIX B  
SCOPE OF WORK



## SCOPE OF WORK

### PALEONTOLOGICAL RESOURCES SURVEY

TEBO, SOUTH GRAND, AND OSAGE ARMS  
HARRY S. TRUMAN DAM AND RESERVOIR  
OSAGE RIVER, MISSOURI

#### 1. INTRODUCTION

a. The Government is currently engaged in the construction of the Harry S. Truman Dam and Reservoir project. The reservoir will have a surface area of 55,600 acres at multipurpose pool. The project area contains significant paleontological resources. To date there has been one Corps sponsored survey for spring deposits containing paleontological resources. This survey yielded negative results for the Pomme de Terre arm. However, there have been reported finds elsewhere in the reservoir area. The work defined herein to be performed by the Contractor will be to perform a site specific survey for deposits of vertebrate paleontological resources within the project area.

b. The work defined herein is authorized for funding under Public Law 86-523 as amended by Public Law 93-291.

#### 2. SCOPE

a. This is a two part study designed to locate sites containing significant paleontological deposits and to analyze existing collections that have not been previously described. The study will involve (1) analysis of existing materials outside the Pomme de Terre arm, except those from the Koch Spring, and (2) a site specific survey designed to locate and evaluate areas where materials have been or may be recovered.

b. The Contractor shall conduct this study in a professional manner and shall utilize those avenues prescribed to conduct the survey and determine the relative importance of each resource encountered. The area of concern shall be the Tebo Creek, South Grand, and Osage arms of the project and the Koch Spring. The Contractor shall prepare a report of findings as described in paragraph 6.

#### 3. COORDINATION

a. The Contractor shall attend the quarterly WORK meetings to insure coordination with the archeological survey being conducted in the same area.

Incl 1

b. Prior to initiation of actual field activities the Contractor shall coordinate all field schedules and activities with the appropriate project cultural resources coordinator.

#### 4. STUDY APPROACH

The work to be performed by the Contractor shall be closely coordinated with the Contracting Officer or his representative. The Contractor shall perform the following activities as requirements of this study.

a. An analysis of the known paleontological sites and the existing collections from the project area shall be performed in the following manner:

(1) Revisit all localities having produced only isolated fossil materials. Ascertain as closely as possible the original context of faunal recovery. This material shall be adequately described and published within a professional context. (Actual publication need not be accomplished during the term of the contract but a letter of intent to publish shall be supplied).

(2) Tackner Locality (Warsaw Swamp) and Koch Spring (Pomme de Terre Swamp) shall be revisited and existing collections located and analyzed. All materials should be described and published within a professional context. (Actual publication need not be accomplished during the term of the contract but a letter of intent to publish shall be supplied).

(3) Site specific survey conducted concentrating in areas not previously surveyed but where evidence of ancient springs has been reported. This survey shall utilize remotely sensed data, referrals from local residents familiar with the area, records of the archeological survey, and field investigation. Upon discovery of a site the use of core-drilling and/or trenching equipment shall be employed, as necessary. No salvage excavation shall be performed under this contract. The potential of the discovered sites shall be assessed in the light of previous endeavors and experience.

b. The Contractor shall provide a safe working environment for all persons in his employ as prescribed by EM 385-1-1, "General Safety Requirements."

c. The Contractor shall be responsible for any damage to crops which may result from testing work. The Contractor shall attempt to obtain right-of-entry on private land proposed for acquisition. If permission is denied, such action shall be noted in the final report of findings.

d. Staff and Facility Requirements.

(1) Project Director. The person in charge of this project must have the doctorate or an equivalent level of professional experience as evidenced by a publication record that demonstrates experience in field project formulation, execution, and technical monograph reporting.

(2) Paleontologist. The minimum formal qualifications for individuals practicing paleontology as a profession are a B.A. or B.Sc. degree from an accredited college or university, followed by two years of graduate study with concentration in paleontology and at least two summer field schools or equivalent under the supervision of paleontologists of recognized competence. A master's thesis or its equivalent in research and publications is highly recommended, as is the Ph.D. degree.

(3) Standards for Consultants. Personnel hired or sub-contracted for their special knowledge and expertise must carry academic and experiential qualifications in their own fields of competence.

(4) Institutional or Corporation Qualification. The Contractor must provide, or demonstrate access to the following capabilities:

(a) Adequate permanent field and laboratory equipment necessary to conduct operations defined in the scope of work. However, this qualification may be waived under circumstances of extreme need through negotiation.

(b) Adequate laboratory and office space and facilities for proper treatment, analysis, and storage of specimens and records likely to be obtained from the project. This does not necessarily include such specialized facilities as pollen, geochemical, or radiological laboratories, but does include facilities sufficient to properly preserve or stabilize specimens for any subsequent specialized analysis.

e. Collections. The collections shall be stored in containers clearly marked "Property of the U.S. Government, Corps of Engineers, Kansas City District." These materials may be stored at the contracting firm's laboratories for use in future studies or at a repository agreed upon by the Corps, the Contractor, and the Missouri State Historic Preservation Officer. Retrieval of these materials by the U. S. Army Corps of Engineers for use by them is reserved. If materials are to be removed from the agreed upon facilities, this action must be previously approved by the Contracting Officer or his representative.

f. Court Action. In the event of controversy or court challenge, the principal investigator(s) (that person(s) responsible for the validity of the material presented in the report) shall testify on behalf of the Government in support of the report findings.

## 5. AVAILABILITY OF DATA

a. It is intended that the Contractor shall conduct all necessary review of literature, governmental reports, and other sources of information in the depth required for a comprehensive coverage of the study. The Contractor is expected to accumulate, develop and interpret all needed scientific and technological information and data.

b. The Government will provide the Contractor with available background maps, remotely sensed data, files, reports, and correspondence as needed. In addition, the Government will provide support to the Contractor regarding suggestions on data sources, format of study outline and report, and review of study progress.

c. The Government will furnish the right-of-entry to all Government owned property associated in the Harry S. Truman project.

## 6. SCHEDULE OF WORK

a. The Contractor shall pursue the study in a timely manner to meet the following schedule:

(1) An original and twelve (12) copies of a draft report of findings, together with six (6) copies of background data, shall be submitted to the Contracting Officer for peer and Governmental review on or before 15 April 1977. If excessive inclement weather or other delays are incurred, this day may be extended to one mutually agreed upon between the Government and the Contractor.

(2) Thirty (30) calendar days after the return of the draft report by the Government, or within ten (10) months after receiving the notice to proceed, whichever is later, the Contractor shall submit the original only of the report of findings. The Government will reproduce the report and supply the Contractor with ten (10) copies for his personal use.

b. The report shall contain the following:

(1) Discussions of collections, to include the following:

(a) Description of taxa.

(b) Abundance.

- (c) Description of habitat.
- (d) Discussion/comparison with other collections.

(2) Listing of materials and locations of finds for previously investigated sites.

(3) Site specific survey results to include the following:

- (a) Listing of localities investigated.
- (b) Description of locations.
- (c) Brief descriptions of any materials recovered.
- (d) Discussion of relative importance.
- (e) Recommendations for further work, if any, or for preservation.

(4) The report should also contain photographs, drawings, and maps to provide for visual interpretation.

(5) A glossary of technical terms shall be included.

(6) An abstract not exceeding 250 words.

(7) All measurements shall appear in the metric system with their English equivalents in parenthesis ().

(8) Attached to the letter of transmittal for the final report shall be a Certificate of Authenticity from a recognized expert not employed by the Contractor attesting to the validity of the materials recovered.

(9) A lengthy summary written in a style suitable for reading by persons not professionally trained as paleontologists shall be included with the final report.

c. The original of the final report, which shall be authored and signed by the principal investigator, shall be furnished in either one and one-half spaced or double spaced typing. The spacing of all margins shall be arranged for reproduction on both sides of a page, 8 by 10-1/2 inches in size, except for fold-outs. All text and illustrations must be of a quality suitable for reproduction.

d. If the project director is not the principal investigator, the abstract and a review of the report shall be authored and signed by the project director and included as a preface to the report.

APPENDIX C  
CONTRACTOR'S VITA

## VITA

JEFFREY J. SAUNDERS, Visiting Curator of Vertebrate Paleontology  
and Research Associate, Quaternary Studies  
Center, Illinois State Museum, Springfield,  
Illinois 62706

Born: Minneapolis, Minnesota, 12 December 1943

## Education:

- 1966 B.A. University of Minnesota, Minneapolis (Geology)
- 1970 M.S. University of Arizona, Tucson (Geochronology)
- 1975 Ph.D. University of Arizona, Tucson (Geosciences)

## Experience:

- 1966 Earth Sciences Laboratory Technician, McMurdo Sound,  
Antarctica
- 1967-68 Teaching Assistant, Paleontology, University of  
Arizona, Tucson
- 1968 National Science Foundation Summer Trainee
- 1968-69 Preparator, Laboratory of Paleontology, University  
of Arizona, and Paleontologist, Arizona State  
Museum, Tucson
- 1969-70 Research Assistant, Paleontology, University of  
Arizona, Tucson
- 1970-71 National Science Foundation Trainee, University of  
Arizona, Tucson
- 1971-73 Research Associate, Illinois State Museum, Spring-  
field
- 1973 Teaching Associate in Geosciences, University of  
Arizona, Tucson
- 1974 Research Associate in Geosciences, University of  
Arizona, Tucson
- 1975- Visiting Curator of Vertebrate Paleontology and  
Research Associate, Illinois State Museum, Spring-  
field

## Field Work:

- 1967 Archaeological excavator, Murray Springs Clovis Site, Cochise County, Arizona
- 1968 Geological reconnaissance, Arizona
- 1969 Geological reconnaissance and screen washing, southern Arizona
- 1970 Vertebrate fossil collection, Murray Springs, Cochise County, Arizona
- 1971 Vertebrate fossil collection, Murray Springs, Cochise County, Arizona, and Boney Spring, Benton County, Missouri
- 1972 Vertebrate fossil collection, Hudson-Meng Paleo-Indian Site, Sioux County, Nebraska
- 1973 Vertebrate fossil collection, Jones Spring, Hickory County, Missouri
- 1974 Vertebrate fossil collection, Lehner Ranch Clovis Site, Cochise County, Arizona
- 1975-77 Vertebrate fossil collection, Jones Spring, Hickory County, Missouri
- 1976-77 Paleontological resources survey, Harry S. Truman Dam and Reservoir Project Area, Missouri

## Professional Organizations:

Society of Vertebrate Paleontology  
 American Quaternary Association  
 American Association for the Advancement of Science  
 The Paleontological Society  
 International Quaternary Association

## Publications:

Saunders, Jeffrey J.

- 1977 Late Pleistocene vertebrates of the western Ozark Highland, Missouri. *Reports of Investigations* No. 33, Springfield: Illinois State Museum. x + 118p.



In press

Lehner Ranch revisited. *The Museum Journal*, Lubbock:  
Texas Tech University.

In preparation

Untangling a mastodon graveyard. *Natural History*,  
New York: American Museum of Natural History (with  
C. J. Schuberth).

The Quaternary history of the Ozark Highland.  
*Science*, Washington, D.C.: American Association for  
the Advancement of Science. (with R. B. McMillan,  
J. E. King, C. V. Haynes, and W. R. Wood).

APPENDIX D

PERMISSION TO REPRODUCE COPYRIGHTED MATERIALS

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November 4, 1977

Dr. Jeffrey J. Saunders  
 Illinois State Museum  
 Springfield, Illinois 62706

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*George W. Corner*  
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